Flexible Display System Gaining Users

Multicolor Nortronics 'Vigicon' accepts wide variety of inputs, presents data in many forms; applications include spacecraft mission analysis

by Charles D. LaFond

AN EXTREMELY versatile, multicolor projection display system, developed by the Nortronics Division of Northrop Corp., is rapidly finding application in diverse aerospace roles throughout the country.

Already in use by NASA, the Air Force and the Navy at several installations for each organization, another new system employing 24 projectors in three units is expected to be purchased soon by the Navy for installation at Roosevelt Roads, Puerto Rico. There it will be employed by the Atlantic Fleet Weapons Range during tactical weapons exercises.

Called Vigicon, the Nortronics overall system design uses all-solid-state circuitry and modular building blocks permitting great flexibility in fabrication of units for each different application.

A probable key to the rapid acceptance and use of Vigicon is the system's versatility in accepting presentation data from a variety of input sources, including many types of communication and data processing equipment. Of equal importance to broad application of the system are the many forms of data presentation available as options.

Each display configuration can employ several of each of three basic projector types:

—A reference projector providing static map, chart, or other background presentations from slides, automatically selected from storage magazines.

—A plotting projector that generates any form of line imagery (e.g., graphics, alphanumerics, and symbols).

—A spotting projector also provides dynamic traces as with the plotter, but its displays of instantaneous vector position are temporary presentations.

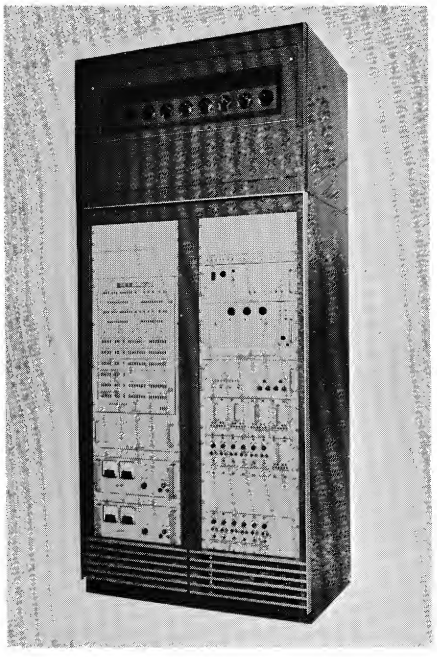
Systems according to developers, can be designed for theater or console display, front or rear projection.

● **Projector description**—Although each of the three projector types is similarly constructed, the plotting projector is the most sophisticated due to its functional nature.

A real-time plotting device, it projects images as they are generated. Employing four functional units—a light generator, slide-change mechanism, X and Y servomechanisms and the projection lens assembly, the device differs from the other projectors primarily in its X-Y plotting mechanism. These control movement of an opaque coated plate in two orthogonal directions. A third control tips the plate slightly into contact with a stylus or scriber. Thus, with an analog input from a processor providing data related to some dynamic situation, as a trace is made light is transmitted through the plate to the viewer screen.

Similarly, using a symbol generator as an input source, plot signals and voltages for plate movement can be ap-

LEFT: Vigicon demonstration display unit is capable of presenting command and control information in real time and in color. Both dynamic and static displays can be presented simultaneously on large and small screens. RIGHT: Spacecraft mission analysis display was built by Nortronics Div. of Northrop Corp. for IBM for installation at Goddard Space Flight Center.



plied to generate and display alphamerics and symbols.

Light source for the projector is an incandescent cylindrical lamp (300-1200 watts). Air cooled, the lamp also is provided with filters that reduce infrared radiation and thus help prevent heat damage to the projector slides. The remaining light passes through condensing lenses. On failure, a second lamp is moved into position within 0.5 second. (Failure is indicated externally so that the dead lamp can be manually replaced by the operator.)

For color, a six-filter turret can be provided about the lamp. Any color assignment, either manually or remotely controlled, is achieved in 1 second by rotating the turret until the desired color aperture is in the optical path.

A 40-slide magazine and handling mechanism is provided for projection of static graphics, also either manually or automatically operated. Slides are coated glass types mounted in stainless steel frames.

Low-distortion projection lenses complete the unit. Both focus and translation are adjustable.

The reference projector is identical in its configuration to the plotting projector, with the exception of the plotting mechanism, and stylus.

In the spotting projector, the slide-change mechanism and slide magazine are eliminated. Also, the stylus plate in the X-Y servo carriage is replaced by a slide already bearing some needed symbol which is to be moved over the display screen. For example, the symbol could be a ship that is moved by the X-Y servomechanism to show a continuously updated position.

If desired, a readout of coordinates of a symbol location can be obtained through the use of digital encoders, driven in parallel with the servo feedback potentiometers.

A single projector chassis weighs about 15 pounds and measures approximately 15.5 x 4 x 11 inches with the projectors mounted on 4-inch centers.

● **Current applications**—Operational displays so far developed and installed by Nortronics vary in configuration with each facility. The number of projectors employed for each unit vary with need, but the limit is about eight in a row (to prevent lateral distortion at the screen).

A large screen forward-projection system is used at the Navy's Anti-Submarine Warfare School at Norfolk, Va. In the ASW simulator there, a data processor provides inputs to the display system for depicting instantaneous ship's position of multiple tracks along with dynamic annotations. Three units are employed for presentation on three 10 x 10-ft. screens. A similar system will be installed at the San Diego ASW School for Pacific Fleet Task Force training.

Four systems employing folded optics and 30 x 30-in screen consoles will be built for use in an SH-2 ASW Helicopter Crew Trainer facility for the Naval Training Device Center.

A recently developed Vigicon system using a 6 x 6-ft. screen has been installed as a part of the IBM computer complex at NASA's Goddard Space Flight Center, Md. Designed for use as a spacecraft mission analysis display, it will be used initially for *Gemini* and *Apollo* trajectories or orbital plots and will be operated in real-time. Predicted or planned orbit versus actual orbit and predicted impact point will also be displayed.

Another NASA system, used for the Manned Spacecraft Terminal Landing System, has been installed in an air transportable mobile van at the Manned Spacecraft Center in Houston.

Other recent Vigicon systems include one to be delivered in October for the Navy's AUTEC Range in the Bahamas and one for use in the *X-15* experimental flight test program at Edwards AFB, Calif. ■

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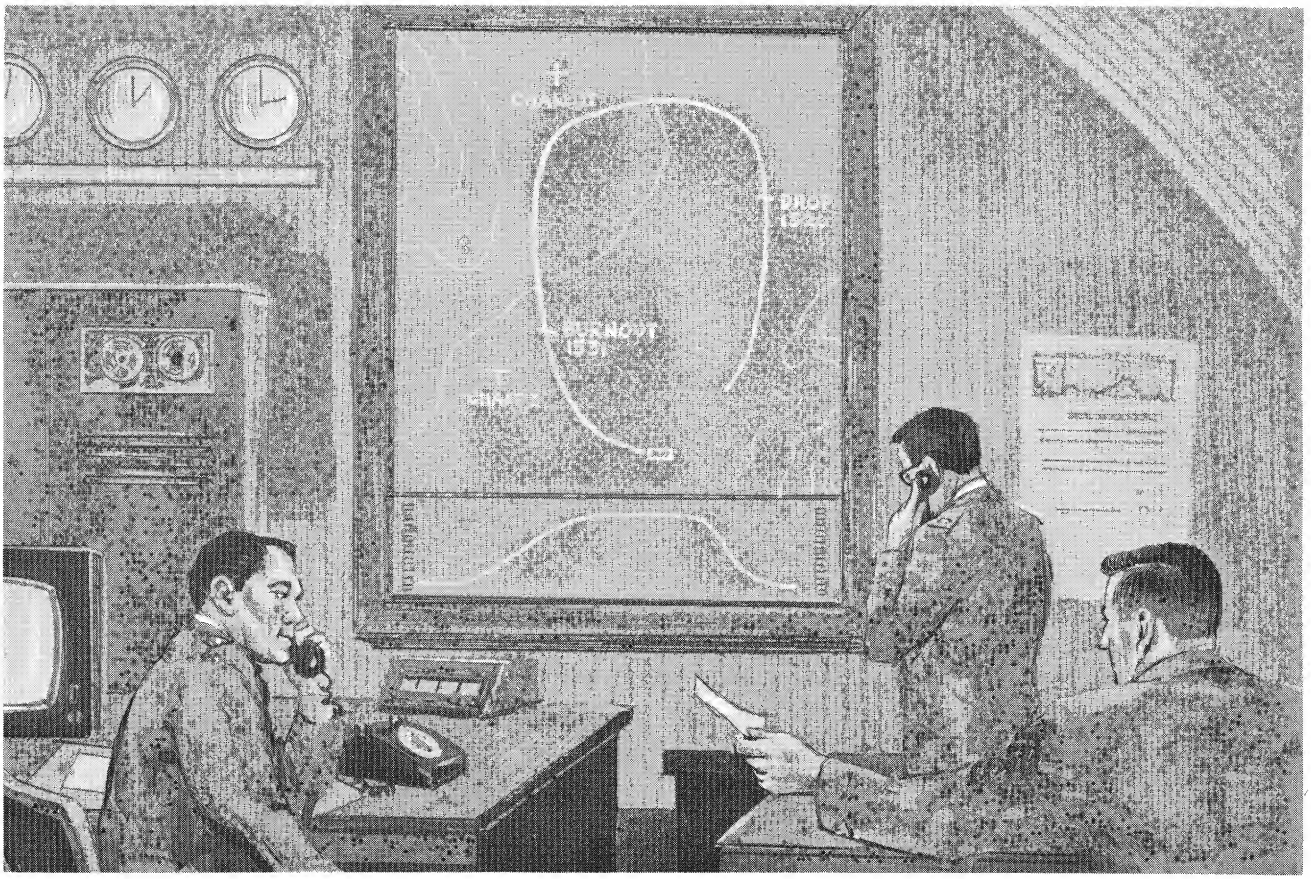
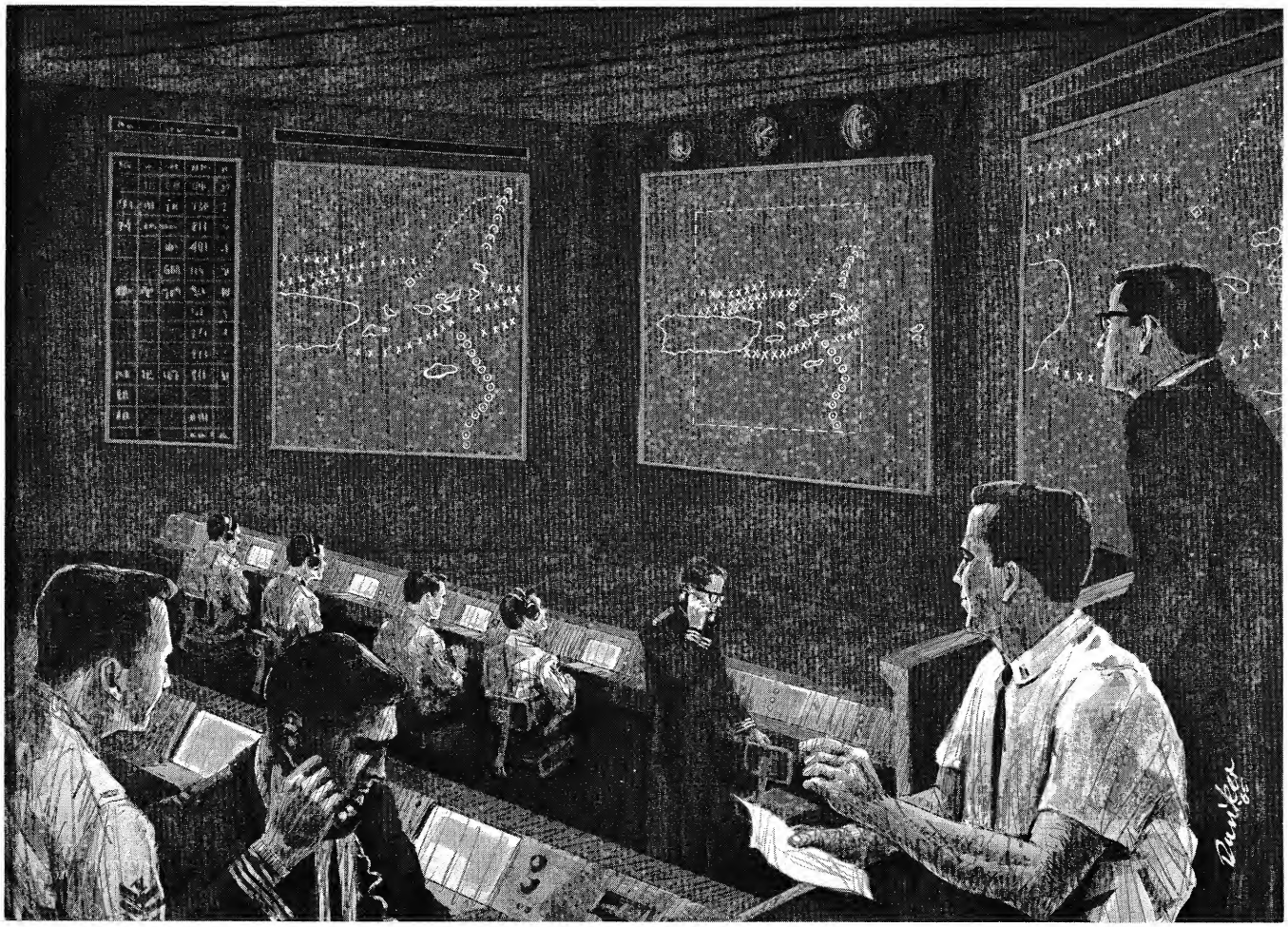
Project: AUTEC Principal Real Time Display
Customer: ITT Federal Labs, Nutley, N.J.
User: U. S. Navy Underwater Ordnance Laboratory, St. Andros, Bahama Islands

Missiles and weapons testing both above and below the sea are displayed on a large, theater type screen at the control center for the U. S. Navy's first underwater test range in the Bahamas. The display will develop a real time presentation to provide observers with immediate information on all range activities. The dynamic movements of all submarines, ships, aircraft, underwater weapons and missiles are recorded on a 10 x 10 ft "split" screen. The dual display allows for coincident comparison of graphic targeting against profile display of altitude and depth data.



Project: X-15 Flight Monitor Display
Customer: NASA
User: NASA Flight Research Center, Edwards AFB, California

The various mission modes of the X-15 experimental flights are permanently recorded on the multicolor, rear projection, large screen display. Colored traces, each depicting a phase of the operation, are generated in real time to present the path of the X-15 during takeoff under the B-52, drop and trajectory, and burnout descent. The instantaneous positions of the "chase" planes with respect to the prime vehicle are also displayed on the 4 x 5 ft "split" screen, altitude being recorded on the lower 1/5 of the screen. Reference background and symbology capability are additional features of this operational type system.



Project: Atlantic Fleet Weapons Range
Customer: Fishbach & Moore
Dallas, Texas
User: AFWR Control Center
Roosevelt Roads, Puerto Rico

This high density central command and control system is to evaluate the tactical deployment of weapon systems in the fleet inventory. Evaluation is accomplished by recording actual fleet exercises (i.e., ship positions, aircraft movements, weapon firings, troop landings, target drone tracking) in real time, multicolor and time selectable track history.

The dynamic data, both computer and manually prepared, is presented on three 8x8 ft. (operationally independent) screens for instantaneous viewing during the exercise and for critique and study after the exercise. A significant feature of the display system is that dynamic movements are portrayed utilizing symbology compatible with Navy and Marine Tactical Data Systems (NTDS & MTDS). In addition, the display is capable of presenting alphanumerical data, special symbols, vectors and background material.